

LOWER CHINLE GROUP (UPPER TRIASSIC:UPPER CARNIAN) TETRAPODS FROM THE VICINITY OF CAMERON, ARIZONA

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Abstract—Vertebrate fossils from the lower Chinle Group housed at the Museum of Northern Arizona (MNA) represent some of the stratigraphically lowest Upper Triassic tetrapods collected on the Colorado Plateau. Unfortunately, many of these fossils were collected decades ago, and the recorded locality data lack crucial geographic and stratigraphic detail. Tetrapods from MNA locality 213, northwest of Cameron, include fragmentary phytosaur teeth and bones and a variety of coprolites that were probably derived from the Shinarump Formation or the lowermost Cameron Formation. MNA locality 491 encompasses all MNA collections made from an area “3 to 4 miles” (4.8–6.4 km) east of Cameron as well as those made in the general vicinity of Tanner’s Crossing, approximately 2.5 miles (4.0 km) southeast of Cameron. Tetrapods from MNA locality 491 include a well-preserved skull and several pectoral elements assigned to the metoposaurid amphibian *Buettneria perfecta* and more fragmentary reptile material, at least some of which was probably derived from the Cameron Formation. These fossils appear to represent, at least in part, the first tetrapod records from the Cameron Formation and are among the stratigraphically lowest Chinle tetrapods from the Colorado Plateau.

Keywords: Metoposaur, vertebrates, Cameron Formation, Chinle, *Buettneria*

INTRODUCTION

Small collections of Upper Triassic tetrapod fossils from the Chinle Group near Cameron, Arizona housed at the Museum of Northern Arizona are particularly interesting because of their low stratigraphic position (Fig. 1). Here, we list those fossils by locality and taxon (Table 1), illustrate the most diagnostic of these fossils (Fig. 2), consider their stratigraphic position (Figs. 1,3) and discuss their biochronological importance (Fig. 4). In this paper, MNA = Museum of Northern Arizona, Flagstaff.

PALEONTOLOGY

MNA records include two lower Chinle Group tetrapod localities in the vicinity of Cameron: MNA localities 213 and 491 (Fig. 1). Locality 213 is immediately north and west of town, prob-

ably in the Shinarump Formation. Tetrapod fossils collected from this locality are among the oldest Chinle vertebrates. Specimens from MNA locality 213 consist primarily of coprolites (MNA pl. 615–627) and isolated phytosaur material, including a blade tooth (MNA pl. 778), dorsal vertebra (MNA pl. 1348), and the proximal end of a humerus (MNA pl. 702).

MNA locality 491 is an areal locality for the region generally “east” of Cameron and appears to represent at least two, and probably three, localities. These are variously referred to on specimen labels and locality forms as “four miles [6.4 km] east of Cameron,” “three miles [4.8 km] east of Cameron,” and “near Tanner’s Crossing,” which is approximately 2.5 miles (4.0 km) southeast of Cameron (Fig. 1). The most notable elements of this fauna are several well-preserved elements of the metoposaurid amphibian *Buettneria perfecta* (Fig. 2), although numerous fragmentary phytosaur and metoposaur remains have been identified as well (Table 1).

Well-preserved metoposaurid material from MNA locality 491 includes a nearly complete skull (MNA V. 701: Fig. 2B), interclavicle (V. 706: Fig. 2E–F), and partial (V. 707: Fig. 2G) and com-

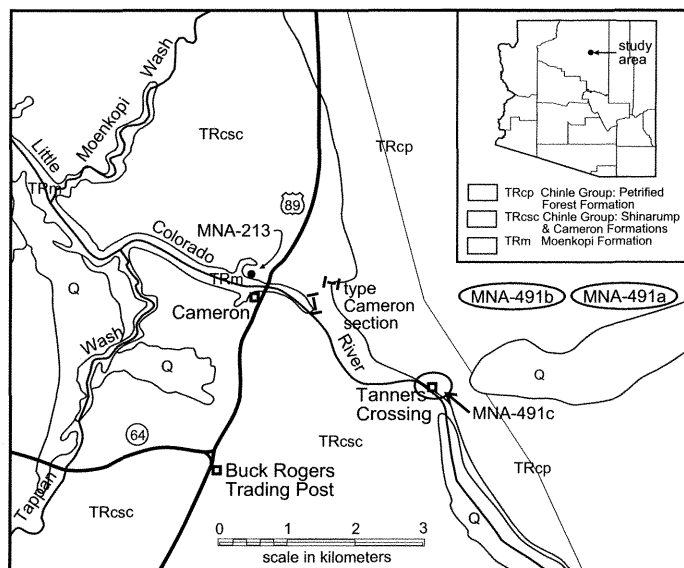


FIGURE 1. Index and geological maps showing the general location and geology of MNA localities 213 and 491.

TABLE 1. List of specimens from MNA localities 213 and 491.

Locality	MNA #	Element	Taxon
213	pl. 615–627	coprolites	Tetrapoda indet.
	pl. 778	blade tooth	Parasuchidae
	pl. 1348	dorsal vertebra	Parasuchidae
	V. 702	proximal humerus	Parasuchidae
491	V. 703	right occipital condyle	Metoposauridae
	V. 704	skull fragments	Metoposauridae
	V. 701	skull	<i>Buettneria perfecta</i>
	V. 705	left clavicle	<i>Buettneria perfecta</i>
	V. 706	interclavicle	<i>Buettneria perfecta</i>
	V. 707	partial left clavicle	<i>Buettneria perfecta</i>
	pl. 691	caniniform tooth	Parasuchidae
	pl. 694	distal tibia	Parasuchidae
	pl. 698	proximal left femur	Parasuchidae
	pl. 699	fragmentary left femur	Parasuchidae

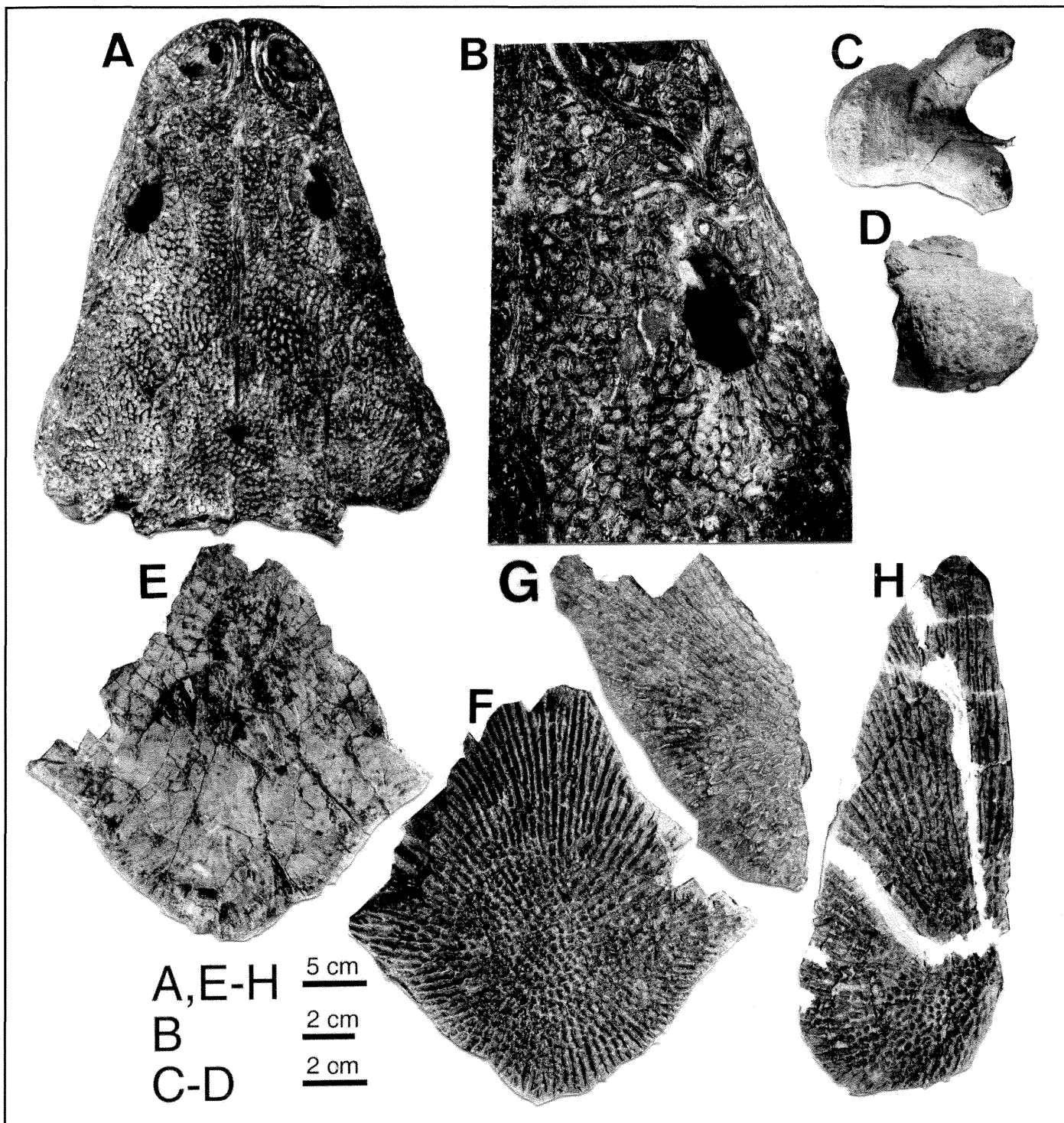


FIGURE 2. Metoposaurid amphibian fossils from MNA locality 491. **A-B**, MNA V. 701, skull of *Buettneria perfecta* in **A**, dorsal and **B**, close-up of orbital region; **C-D**, MNA V. 703, right occipital condyle of indeterminate metoposaurid in **C**, medial(?) and **D**, posterior views; **E-F**, MNA V. 706, metoposaurid interclavicle in **E**, dorsal and **F**, ventral views; **G**, MNA V. 707 metoposaurid partial left clavicle in ventral view; **H**, MNA V. 705 metoposaurid left clavicle in ventral view.

plete (V. 705: Fig. 2H) left clavicles of a metoposaurid amphibian, probably from a single site. Additional, more fragmentary metoposaurid fossils that exhibit darker coloration, indicating different preservation, represent at least one other locality (e.g., V. 703: Fig. 2C-D). The complete skull preserves a lachrymal that enters the orbit (Fig. 2B), which is the diagnostic characteristic of *Buettneria perfecta* among the metoposaurids (Hunt, 1993).

STRATIGRAPHY

As seen in Figure 1, the only Upper Triassic strata exposed in the vicinity of MNA localities 213 and 491 pertain to the lower Chinle Group as defined by Lucas (1993). In the vicinity of Cameron, the lower Chinle Group disconformably overlies the Middle Triassic (Anisian) upper Moenkopi Formation and con-

sists of the following units (in ascending stratigraphic order): Shinarump Formation, Cameron Formation, and Blue Mesa Member of the Petrified Forest Formation (Fig. 3). The Cameron Formation was previously known as the "sandstone and mudstone member" of the Chinle Formation *sensu* Stewart et al. (1972), and was mapped as such by Cooley et al. (1969). When Lucas (1993) raised the Chinle to group-level, he also defined and described a type section of the "sandstone and mudstone member" as the Cameron Formation.

Most of the specimen labels for fossils from MNA localities 213 and 491 indicate that the Shinarump Formation was the fossiliferous horizon. If accurate, this makes these fossils the oldest Chinle tetrapod fossils collected on the Colorado Plateau. The available information indicates that locality 213 is indeed in the Shinarump Formation. Notably, locality 213 is relatively precisely located on MNA maps and appears to be in the valley of the Little Colorado River, where the walls of the valley are capped by Shinarump Formation deposits. Even if the fossils were collected from Recent lag deposits above the valley, their stratigraphic provenance would still be lowermost Cameron Formation.

Locality 491, variously referred to as, "four miles [6.4 km] east of Cameron" (the bulk of the fauna), "three miles [4.8 km] east of Cameron" (fragmentary material), and "Near Tanner's Crossing" (MNA pl. 703; Fig. 2C-D), is more difficult to assess. Strictly speaking, the area four miles due east of Cameron is in the Blue Mesa Member of the Petrified Forest Formation as mapped by Cooley et al. (1969) (Fig. 1). This horizon is probably

comparable to that of the stratigraphically low vertebrate fossil assemblages from the Petrified Forest National Park (Fig. 3; Lucas and Heckert, 1996; Heckert and Lucas, 1997). The area near Tanner's Crossing is largely developed in the Cameron Formation but, near the Little Colorado River, there are some outcrops of the Shinarump Formation, so the exact provenance of these specimens remains equivocal. We suspect that at least some of these specimens were recovered from the Cameron Formation, which would make them the first tetrapod fossils identified from that unit.

BIOCHRONOLOGY

All lower Chinle Group units are of Carnian age (Lucas, 1993, 1997, 1998). Available biochronologic subdivision by megafossil plants, pollen, invertebrates, and tetrapods indicates that the Shinarump Formation is Otischalkian (late early to early late Carnian) and that the Blue Mesa Member is Adamanian (latest Carnian) (Lucas, 1993, 1997). The Bluewater Creek Formation, deposited south and west of the study area at a stratigraphic position equivalent to the Cameron Formation, is of well-constrained Adamanian (latest Carnian) age in west-central New Mexico and east-central Arizona (Lucas and Heckert, 1996; Heckert and Lucas, 1997). The homotaxial position of the Cameron Formation indicates that it, too, is probably of Adamanian age.

The fossils from the Chinle Group in the vicinity of Cameron support this biochronology. Megafossil plants, specifically the bennettitalean *Eogingkoites*, from the Shinarump Formation northeast of Cameron, are consistent with an Otischalkian age for the Shinarump Formation in this area (Ash, 1977; Lucas, 1997). All of the tetrapod fossils documented here are unambiguously Late Triassic in age. Large metoposaurids (*Metoposaurus*, *Buettneria*) are most common in Otischalkian and Adamanian strata in the Chinle, and the "acme zone" of *Buettneria* occurs across the American Southwest in strata of Adamanian age (Lucas and Hunt, 1993). Thus, multiple lines of evidence suggest that the fossils from MNA locality 213 and at least some of the fossils from MNA locality 491 are among the oldest tetrapods known from the Chinle Group.

CONCLUSIONS

Tetrapod fossils from MNA localities 213 and 491 appear to be among the stratigraphically oldest tetrapods collected from the Upper Triassic Chinle Group on the Colorado Plateau. It appears likely that the collection from MNA locality 213 was made from

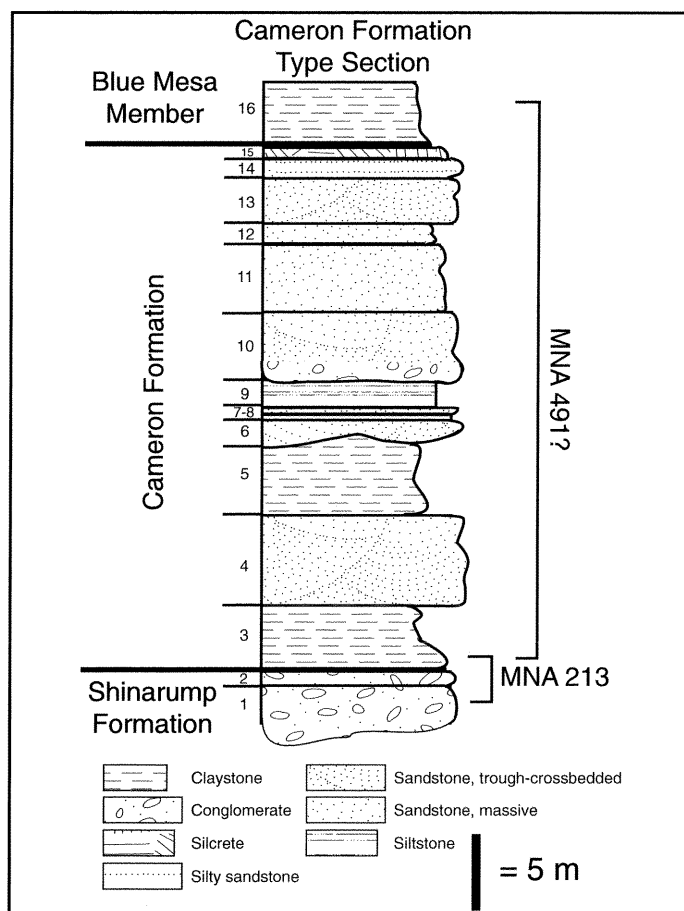


FIGURE 3. Stratigraphic column of lower Chinle Group strata in the vicinity of Cameron, after the type Cameron Formation section described by Lucas (1993). Bars on the far right indicate the probable stratigraphic position of MNA localities 213 and 491.

Late Triassic	Rhaetian	202 Ma	
		Apachean	no body fossil records in Arizona
	Norian		Ward Terrace (Owl Rock Mbr) vertebrate assemblage
		Revuelitian	Painted Desert Mbr vertebrate assemblage
	Late Carnian	218 Ma	Blue Mesa Mbr vertebrate assemblage
		Adamanian	Bluewater Creek Fm vertebrate assemblage
		228 Ma	age of MNA locality 491?
		Otischalkian	age of MNA locality 491? Shinarump Fm MNA locality 213
		202 Ma	

FIGURE 4. Age of Upper Triassic vertebrate fossil localities in Arizona. Cameron-area localities highlighted in bold text. Note that these are the oldest (locality 213) or among the oldest (locality 491) Upper Triassic tetrapods in the state.

the Shinarump Formation or, perhaps, from lag deposits eroded from the basal Cameron Formation. The more fragmentary material from MNA locality 491 in the vicinity of Tanner's Crossing may well have been derived from the Shinarump Formation, but all of the better material was probably found in the Cameron Formation or, possibly, in the stratigraphically higher Blue Mesa Member of the Petrified Forest Formation. Based on extensive lithostratigraphic correlations, these fossils are among the oldest Upper Triassic tetrapod fossils collected from the Colorado Plateau. In particular, any fossils from the Shinarump Formation would be the stratigraphically lowest identifiable tetrapods from the Colorado Plateau and should be of Otischalkian age. If, instead, these fossils are from low in the Cameron Formation then

they are stratigraphically equivalent to the well-known fauna from the *Placerias* quarry in the Bluewater Creek Formation near St. Johns, Arizona and of Adamanian age. Clearly, additional collecting in these areas could facilitate re-identification of the fossiliferous horizons and produce additional material that would be among the oldest collected from the Chinle.

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